



Evaluation of Livingstone Potato (*Plectranthus esculentus*) Utilization Patterns and Post-Harvest Challenges in Some Local Government Areas of Taraba State, Nigeria

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ABSTRACT

The study evaluated the utilization patterns and post-harvest challenges of Livingstone potato (*Plectranthus esculentus*) in Sardauna, Gashaka and Kurmi Local Government Areas of Taraba State. The objective of the study is to determine and document the utilization patterns and post-harvest challenges of Livingstone potato. The study adopted a multistage sampling technique comprising the purposive selection of three prominent Livingstone potato-producing LGAs in Taraba State (Sardauna, Gashaka, and Kurmi), the selection of two wards per LGA, and the simple random sampling of 270 respondents distributed across the LGAs (150, 70, and 50 respectively). The Data were collected from 270 respondents using structured questionnaires and analyzed using frequencies and percentages. Results showed that 100% of the respondents consumed the tubers, with 45.2% using them both raw and cooked, while 51.9% sold the produce fresh without processing. Medicinal (traditional medicine) use was prominent, particularly for measles (31.5%) and chicken pox (29.6%). Although, 61.1% of farmers reported no processing problems, storage challenges such as quality loss (20.4%) and pest infestation (9.3%) were observed. This study points out low value addition and post-harvest inefficiencies as key issues and recommends improved storage and processing practices to enhance the crop's economic and food security potential.

Keywords: Livingstone Potato, Underutilized-crop, Utilization patterns, Post-harvest challenges, Food security.

INTRODUCTION

Livingstone potato (*Plectranthus esculentus*) is an indigenous and underutilized tuber crop widely cultivated in parts of Sub-Saharan Africa, including Nigeria. It belongs to the family Lamiaceae and is valued for its edible tubers, which are rich in carbohydrates and serve as an important source of energy for rural households. Recent studies have highlighted its increasing relevance in food systems, particularly among rural populations where it contributes to dietary diversity and income generation (Akinola *et al.*, 2020; Tadele, 2019).

In Nigeria, Livingstone potato plays a significant role in the livelihoods of

smallholder farmers, especially in rural communities where it contributes to both food security and household income. However, its production and utilization remain largely traditional with limited adoption of improved agronomic and processing technologies. Previous studies have shown that underutilized crops are mainly cultivated on a small scale and are gradually declining due to low market value, lack of improved varieties and inadequate research attention (Tadele, 2019). Utilization patterns of Livingstone potato are generally restricted to basic household consumption methods such as boiling, roasting and frying. Processing methods have been

reported to significantly influence nutritional and functional properties of root and tuber crop. Furthermore, these crops have considerable potential for value addition, including their use in flour and starch production, which could enhance their economic importance (Akinola *et al.*, 2020). Despite these potentials adoption remains low among rural farmers due to limited awareness and lack of access to appropriate processing technologies.

A major challenges affecting the sustainability of Livingstone potato production is poor post-harvest handling and storage practices. Root and tubers crops are generally highly perishable and susceptible to rapid deterioration, including weight loss, sprouting and microbial spoilage shortly after harvest. Improper storage methods have been reported to result in significant losses within a few weeks after harvest (Kader, 2005). Traditional storage practices such as keeping tubers on a bare floor or in poorly ventilated environments, further aggravate these losses.

Post-harvest challenges not only reduce the availability of the crop for consumption but also limit its market potential and economic value. In rural areas, where access to improved storage facilities and post-harvest technologies is limited, farmers are used to traditional methods that expose produce to mechanical damage, moisture loss and microbial spoilage (Ukpabi *et al.*, 2011). This discourages large-scale production and investment in the crop. Consequently, the combined effects of poor post-harvest handling and limited utilization contribute to the underdevelopment of Livingstone potato as a viable food and cash crop.

In Taraba State, Nigeria, where Livingstone potato is cultivated in areas like Sardauna, Gashaka and Kurmi, there is limited documented information on its utilization patterns and post-harvest challenges among rural farmers. Understanding how the crop is utilized and the constraints faced during post-harvest handling is essential for developing strategies to reduce losses, improve food security and enhance farmers' livelihoods. Therefore, this study aims to evaluate and

document the utilization patterns and post-harvest challenges of Livingstone potato among rural farmers in Taraba State, Nigeria.

MATERIALS AND METHODS

Study Area

The research was carried out in selected Local Government Areas of Taraba State, including Sardauna, Gashaka and Kurmi, where the production of Livingstone potato (*Plectranthus esculentus*) is common. The study area lies between latitudes 6°30' N and 8° 00'N and longitudes 10° 30'E and 11° 30'E.

Sardauna, Gashaka and Kurmi Local Government Areas are located in the southern and southeastern parts of Taraba State, Nigeria. Sardauna and Kurmi Local Government Areas share international boundaries with the Republic of Cameroon, while Gashaka Local Government Area also lies along the eastern border of Taraba State adjoining Cameroon. Within Taraba State, Sardauna shares boundaries with Gashaka and Kurmi Local Government Areas; Kurmi is bounded by Sardauna, Donga, Bali and Ussa Local Government Areas and by Cameroon to the south; while Gashaka is bordered by Adamawa State to the north and Cameroon to the east, and shares boundaries with Sardauna within Taraba State. These border connections influence cross-border agricultural activities and rural livelihoods (Lenshie & Abel, 2012). Sardauna Local Government Area has an estimated land area of about 4,603km² and a projected population of approximately 352,900 people (2022 estimate) based on National Population Commission growth projections from the 2006 census (City population, 2022; NPC/ NBS methodology). The Local Government Area is located in the highland region of Taraba State and is one of the most densely ecologically significant agricultural zones in the State. Gashaka on the other hand, covers an estimated land area of about 8,393km², making it one of the largest Local Government Areas in Taraba State. It has a projected population of about 137,100 people (2022 estimate) based on National Population Commission projections from the 2006 census (City population, 2022; NBS/NPC data

framework). The area is sparsely populated due to the presence of protected forest reserves and Gashaka-Gumti National Park. While Kurmi Local Government Area has an estimated land area of about 4,353km² with a projected population of approximately 143,600 people (2022 estimate) based on National Population Commission projections (City Population, 2022; NBS/NPC methodology). The Local Government Area lies in the forest Savannah transition zone and supports mixed agricultural activities.

Sardauna, Gashaka and Kurmi Local Government Areas experience a tropical wet - and -dry climate characterized by distinct rainy and dry seasons. Climatic conditions in the area are strongly influenced by altitude, relief, and vegetation cover, resulting in spatial variations in rainfall, temperature, relative humidity, and solar radiation across the zone (Danladi *et al.*, 2023).

The rainy season generally extends from April to October, while the dry season last from November to March. Rainfall distribution within the study area is highly influenced by topography, with the highland environment of Sardauna Local Government Area receiving significantly higher rainfall amounts than the surrounding lowland areas of Gashaka and Kurmi. Danladi *et al.* (2023) reported that rainfall within the central district of Taraba State is highest between June and September, during which monthly rainfall exceeds 200mm across most Local Government Areas in the zone. He further observed that mountainous and plateau environments such as Sardauna experience higher precipitation due to orographic effects.

Temperature conditions vary considerably across the study area. Sardauna Local Government Area, located on the Mambilla Plateau, experiences relatively cool temperatures ranging from approximately 16⁰C to 25⁰C because of its high altitude. In contrast, Gashaka and Kurmi Local Government Areas record relatively warmer temperature ranging from about 25⁰C to 32⁰C. Spatial analysis of climate variables in central Taraba revealed that temperature patterns are generally inversely related to rainfall

distribution, with cooler temperature associated with high-rainfall upland areas (Danladi *et al.*, 2023). Relative humidity is generally high during the rainy season but declines considerably during the dry season. Recent studies have also shown increasing temperature trends and fluctuating rainfall patterns across central Taraba, with evidence of rainfall variability and changing climatic conditions affecting agricultural systems and rural livelihoods within the region (Oruonye *et al.*, 2024; Richifa *et al.*, 2025). These climatic changes have important implications for rain-fed agriculture, biodiversity, and food security in the area. The prevailing climatic conditions favor the cultivation of diverse food and cash crops including maize, rice, yam, cassava, irish potato, coffee, cocoa, tea, vegetables and Livingstone potato. The cool temperatures and prolonged wet season of the Mambilla highlands particularly support the cultivation of temperate and tuber crops.

Sardauna Local Government Area is characterized by montane vegetation consisting mainly of grasslands, shrubs and scattered trees adapted to cool climatic conditions. The high -altitude environment supports montane forest patches and extensive grazing fields suitable for livestock production and temperate crop cultivation. Studies on the ecological zones of Taraba State reported that upland areas of Sardauna exhibit unique vegetation characteristics associated with high rainfall and lower temperatures compared to surrounding lowland environments (Danladi *et al.*, 2023). Similarly, forest biodiversity assessments in Taraba State identified montane vegetation and forest ecosystems within the highland regions of the State including the Mambilla Plateau area (Japheth and Meer, 2023). Gashaka Local Government Area vegetation types range from lowland rainforest to southern Guinea savannah and montane vegetation, especially around the Gashaka-Gumti park. Vegetation studies conducted in the park documented rich floral diversity comprising trees, shrubs, grasses, climbers and harbaceous species distributed across different gradients (Akinsoji *et al.*, 2016). Kurmi is dominated by Guinea savannah vegetation

interspersed with forest patches and riparian vegetation along river valley. The area forms part of the forest-savannah transition belt characterized by mixed trees species, shrubs and tall grasses. Vegetation cover in Kurmi has undergone change over time due to deforestation, agricultural activities and settlement expansion. Remote sensing assessments of vegetation dynamics in Kurmi revealed a continuous decline in vegetation cover between 2010 and 2020, accompanied by increasing non-vegetated surfaces such as built-up areas and exposed land surfaces (Atuma, 2023). The soils of Sardauna, Gashaka, and Kurmi Local Government Areas are highly influenced by variation in relief, geology and vegetation cover. In Sardauna, soils are predominantly sandy loam to loamy soils, derived from the highland and volcanic parent materials of the Mambilla Plateau with generally moderate fertility but prone to leaching due to high rainfall (Jugulde and Abdulmumini, 2024). In Gashaka, the soils are mainly sandy clay loam and alluvial soils in lowland areas, while the upland areas exhibit shallow and less fertile soils due to erosion and slope effects (Nafinji & Jafaru, 2025). Similarly, Kurmi is characterized by ferruginous tropical soils and forest-derived soils which are relatively fertile but strongly

affected by continuous cultivation and nutrient depletion. The drainage pattern of the study area is generally dendritic and well-developed, controlled by Benue River basins and its tributaries. Gashaka Local Government Area is drained by numerous rivers and streams, with large portions of its lowlands experiencing seasonal flooding due to flat terrain and proximity river channels. Sardauna drainage is strongly influenced by high altitude relief of the Mambilla Plateau, resulting in fast-flowing streams and good natural drainage, although valley bottoms may retain moisture for longer periods. Kurmi exhibits a mixture of well-drained uplands and poorly drained floodplain areas, particularly near river valleys bordering Cameroon. Poor drainage conditions in lowland areas of Gashaka and part of Kurmi often contribute to water-logging during the rainy season, while upland areas experience rapid runoff and erosion.

Agriculture is the dominant economic activity in all the three Local Government Areas. The majority of the population engages in crop and livestock production, with crop such as maize, rice, millet, yam, cassava, coffee, tea and vegetables widely cultivated across the zone (NBS, 2022, NAERLS and FMARD, 2021).

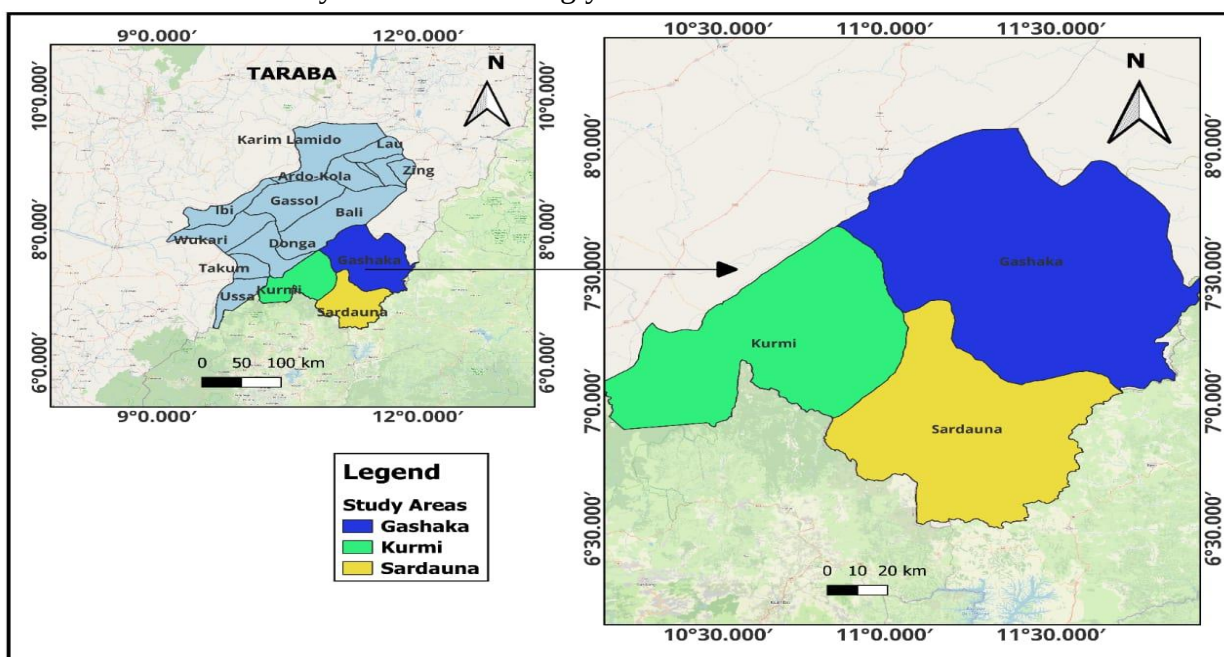


Figure 1: Map of Taraba State showing the study area.

Source: Department of Geography, Taraba State University Jalingo

Research Design

The study adopted a descriptive survey research design. This design was used to obtain information from respondents on the utilization patterns and post-harvest challenges of Livingstone potato (*Plectranthus esculentus*) in the study area.

Sampling Technique and Sample Size

A multistage sampling technique was adopted for the study. In the first stage, Sardauna, Gashaka and Kurmi Local Government Areas were purposively selected due to their prominence in Livingstone potato (*Plectranthus esculentus*) production in Taraba State. In the second stage, two wards were selected from each Local Government Area. In the final stage, Livingstone potato farmers were selected through simple random sampling from the selected wards. A total of two hundred and seventy (270) respondents participated in the study, comprising one hundred and fifty (150) farmers from Sardauna, seventy (70) from Gashaka, and fifty (50) from Kurmi Local Government Areas.

Data collection

Data were collected using a structured questionnaire administered to the respondents.

The questionnaire contained questions designed to obtain information on utilization patterns and post-harvest challenges of Livingstone potato. Oral interviews and field observation were used to complement the questionnaire data.

Data presentation and analysis

Data collected were analyzed using descriptive statistics. Results were presented in the form of table, frequencies and percentages (%).

RESULTS AND DISCUSSION

Utilization of Livingstone Potato and Preparation Methods

All respondents (100%) indicate that the tuberous roots are the edible part of Livingstone potato, confirming its universal acceptance and its strong role in household

food security in rural communities. In line with this, Li *et al.* (2019), reported that underutilized crop still contributes significantly to food and nutrition security in developing countries despite limited commercialization.

The consumption pattern indicate that majority (45.2%) of respondents utilized *Plectranthus esculentus* in both raw and cooked forms, while others prefer either raw consumption (28.9%) or cooked/boiled forms (25.9%). This variation suggests flexibility in preparation methods based on household preferences and available resources. This is consistent with Chivenge *et al.* (2015) and Akinola *et al.* (2020) who noted that neglected and underutilized crops are often consumed using simple traditional methods depending on household preference and availability.

Despite its widespread consumption, more than half of the respondents (51.9%) dispose of the produce through immediate sale after harvest without any form of processing. This reflects minimal value addition and suggests that farmers may not be maximizing the economic potential of the crop. Only a smaller proportion engaged in grading (33.3%) or cleaning and grading (14.8%) prior to marketing (Table 1). This finding is consistent with Affognon *et al.* (2015) who emphasized that poor post-harvest handling and limited processing of root and tuber crops contribute to economic losses among smallholder farmers in Sub-Saharan Africa.

The absence of significant value addition indicates that Livingstone potato remains largely a subsistence crop with low commercialization potential in its current form. This limits income generation opportunities for farmers and reduces incentives for investment in improved production and processing technologies. Furthermore, the dominance of raw marketing practices implies that post-harvest losses and price instability are likely to persist, as farmers are unable to extend shelf life or access higher-value markets through

processing and packaging. Therefore, enhancing farmer capacity in simple processing techniques, grading and storage could significantly improve market value,

reduce wastage and strengthen the crop's contribution to rural livelihoods and food system resilience.

Table1: Preparation for Consumption and Marketing expressed as a percentage of the total respondents (n=270)

Level	Preparation process	Frequency	Percent respondents
Part consumed	Tuberous roots	270	100.00
Preparation for Consumption	Wash, peel and eat raw	78	28.9
	Wash, peel, cooked	70	25.9
	Wash, peel, eat raw or cooked/boiled	122	45.2
Preparation for Marketing	Harvest and sell	140	51.9
	Harvest, clean and grade	40	14.8
	Harvest, grade and sell	90	33.3

Medicinal uses of Livingstone Potato

According to Table 2, *Plectranthus esculentus* is not only consumed as food but also utilized for traditional medicinal purposes. A considerable number of respondents reported its use in managing measles (31.5%) and chicken pox (29.6), while others indicated its relevance in treating stomach-related ailments (25.9%). Fewer respondents associated the crop with the management blood sugar (7.4%) and constipation (5.6%). These observations highlight the importance of indigenous knowledge systems in rural communities, where plant-based remedies are commonly relied upon for primary healthcare (Table 2). This finding support Lukhoba *et al.* (2006), who reported that plants within the Lamiaceae family are widely used in traditional African medicine for treating skin infections and other ailments. Rice *et al.* (2011) also reported that its extracts can be used to treat skin conditions. Similarly, Van Wyk and Wink (2017) documented that many African medicinal plants possess bioactive compounds used in treating infections, inflammation and metabolic disorders. The use of Livingstone potato for stomach ache,

constipation and blood sugar regulation further reflects the reliance on indigenous knowledge systems as also highlighted by Nnadi *et al.* (2013).

The widespread medicinal use of Livingstone potato suggests that the crop has significant ethnobotanical and pharmacological potential, which remains largely under-explored scientifically. This indicates an opportunity for further phytochemical and pharmacological investigations to validate its efficacy and safety for specific health conditions. In addition, the reliance on the crop for primary healthcare implies that it plays a complementary role in rural health systems, particularly where access to modern healthcare facilities is limited. This dependence underscores the need to document and preserve indigenous knowledge before it is lost due to generational change. To some extent, if scientifically validated, the medicinal properties of Livingstone potato could promote its commercialization in herbal and functional food industries, thereby increasing its economic value and encouraging conservation and wider cultivation.

Table 2: Medicinal uses of *Plectranthus esculentus* in the study Area (n=270)

Diseases	Frequency	Percentage (%)
Measles	85	31.5
Chicken pox	80	29.6
Constipation	15	5.6
Stomach ache	70	25.9
Control Blood sugar	20	7.4

Problems Associated with Post-Harvest Handling and Storage of Livingstone potato

The majority of the farmers (61.1%) did not report serious challenges during processing activities (Table 3), suggesting that basic handling operations are relatively simple. However, some respondents identified minor constraints such as the need for extensive cleaning (18.5%), rotting tubers (1.9%), discoloration of hands during handling (12.9%), and difficulty in peeling or breakage of tubers (5.6%). Although, these issues are not widespread, they may affect efficiency and product quality. In terms of storage, over half of the respondents (56.3%) indicated no major difficulties. Nevertheless, a notable proportion experienced issues such as deterioration in quality (20.4%), disease (3.3%), pest infestation (9.3%) and inadequate storage facilities (10.7%) (Table 3). These challenges are likely linked to the highly perishable nature of the crop and the reliance on traditional storage methods.

These findings are consistent with Kader (2005) and Olayemi *et al.* (2012), who reported that root and tuber crops are highly susceptible to post-harvest deterioration when stored under traditional conditions. Similarly, Onwueme and Sinha (1991) emphasized that inadequate storage facilities in tropical regions contribute significantly to post-

harvest losses of perishable crops. This explains the quality decline observed among some farmers in the study areas. The study demonstrates that Livingstone potato is an important crop for both food and medicinal purposes in rural communities. However, its economic potential is constrained by low value addition and moderate post-harvest inefficiencies. This observation agrees with Tadele (2019), who highlighted that many underutilized crops in Africa remain neglected despite their potential to enhance food security and rural livelihoods.

The presence of only moderate post-harvest challenges suggests that while Livingstone potato is relatively easy to handle at the farm level, its perishability and reliance on traditional storage systems significantly limit its shelf life and marketability. The observed issues of quality deterioration, pest infestation and inadequate storage facilities imply that post-harvest losses may still occur at both household and market levels, thereby reducing farmers' income and discouraging large-scale production. In addition, the minimal processing and storage infrastructure in the study area indicate a need for improved post-harvest technologies such as simple drying methods, improved storage structures and better handling practices to reduce losses and enhance product quality.

Table 3: Problems Associated with Post-harvest Handling and Storage of *Plectranthus esculentus* (n=270)

Stage	Problem	Frequency	Percentage (%)
Processing for sale	No problem	165	61.1
	Requires thorough cleaning	50	18.5
	Rotting tubers	5	1.9
	Hard to peel/breaks easily	15	5.6
	Discoloration of hands	35	12.9
Storage	No problem	152	56.3
	Diseases	9	3.3
	Loss in quality	55	20.4
	Poor storage facilities	29	10.7
	Pests	25	9.3

CONCLUSION

Plectranthus esculentus is an important crop among rural farmers in the study areas, serving both nutritional and medicinal purposes, with the tuber (100%) being the primary component utilized. Despite its significance, *Plectranthus esculentus* is predominantly marketed in its fresh form (51.9%) with limited engagement in value addition practices. Although, post-harvest challenges are relatively low as confirmed by majority (61.1%) of the respondents, concerns such as quality deterioration during storage (20.4%) and minor processing constraints persist. Addressing these issues through improved storage techniques and the promotion of value addition strategies would significantly enhance the crop's economic and nutritional benefits.

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